International Conference on 'New Technologies and Sustainable Materials in construction of Low Volume Roads (Rural Roads) and Bridges' 24th to 26th May 2022 at Pragati Maidan, New Delhi

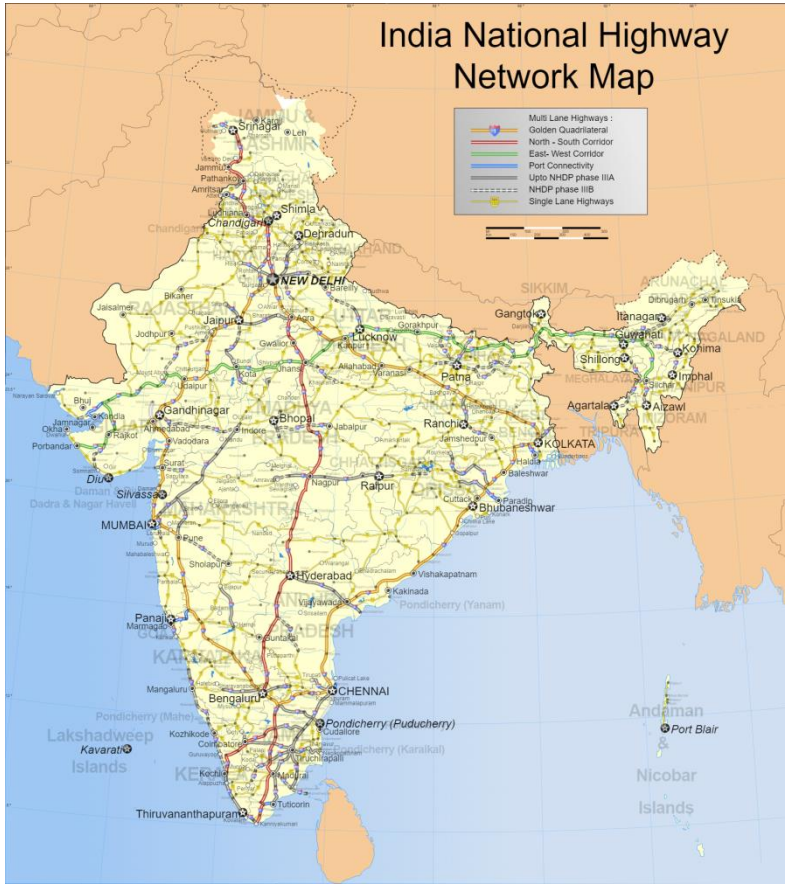
नमस्ते

SOME PERSPECTIVE

Without a single degree, they built roads that have lasted and erternity!

and then, the engineers arrived!

20TH CENTURY URBASATION AND ROAD INFRASTUCTURE



PowerCem Technologies
Innovations for better solutions!

21ST CENTURY– PMGSY
PRIME MINISTER'S VILLAGE ROAD SCHEME – NOVEMBER 2000

Pradhan Mantri Gram Sadak Yojana

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UNDER PMGSY SCHEME
REALISED BETWEEN DECEMBER 2000 – MAY 2022

183,565
No of works cleared
More Info

119,419
New connectivity Works
More Info

64,146
Upgradation Works
More Info

169,000
Completed road works
More Info

704,777 Km.
Completed Length (Kms)
More Info

14,565
In-progress road works (Cleared - Completed)
More Info

Source: http://omms.nic.in/Home/CitizenPage/

ROADCEM
REALISED BETWEEN APRIL 1996 –MAY 2022

Stabilized **18.800.000 m²**

CO_2 reduction of **1.113.000.000 kg.**

Boeing 747 flying **189.000 times** around the world.

Compensated > **2.270.000 m²** trees.

Total time reduction **15 years.**

Costs saving for our customers of **₹605,87,21,188/-**

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OBJECTIVES PMGSY = OBJECTIVES PCT > RESULTS PCT

▪ Achieve Economy in construction	☑	> 40%
▪ Speed up construction time	☑	> 85%
▪ Reduce carbon emmisions	☑	> 74%
▪ Reduce environment degradation	☑	> 80%
▪ Provide sustainable roads	☑	≈ 100%
▪ Reduced maintenance	☑	> 80%
▪ No aggregates	☑	≈ 100%

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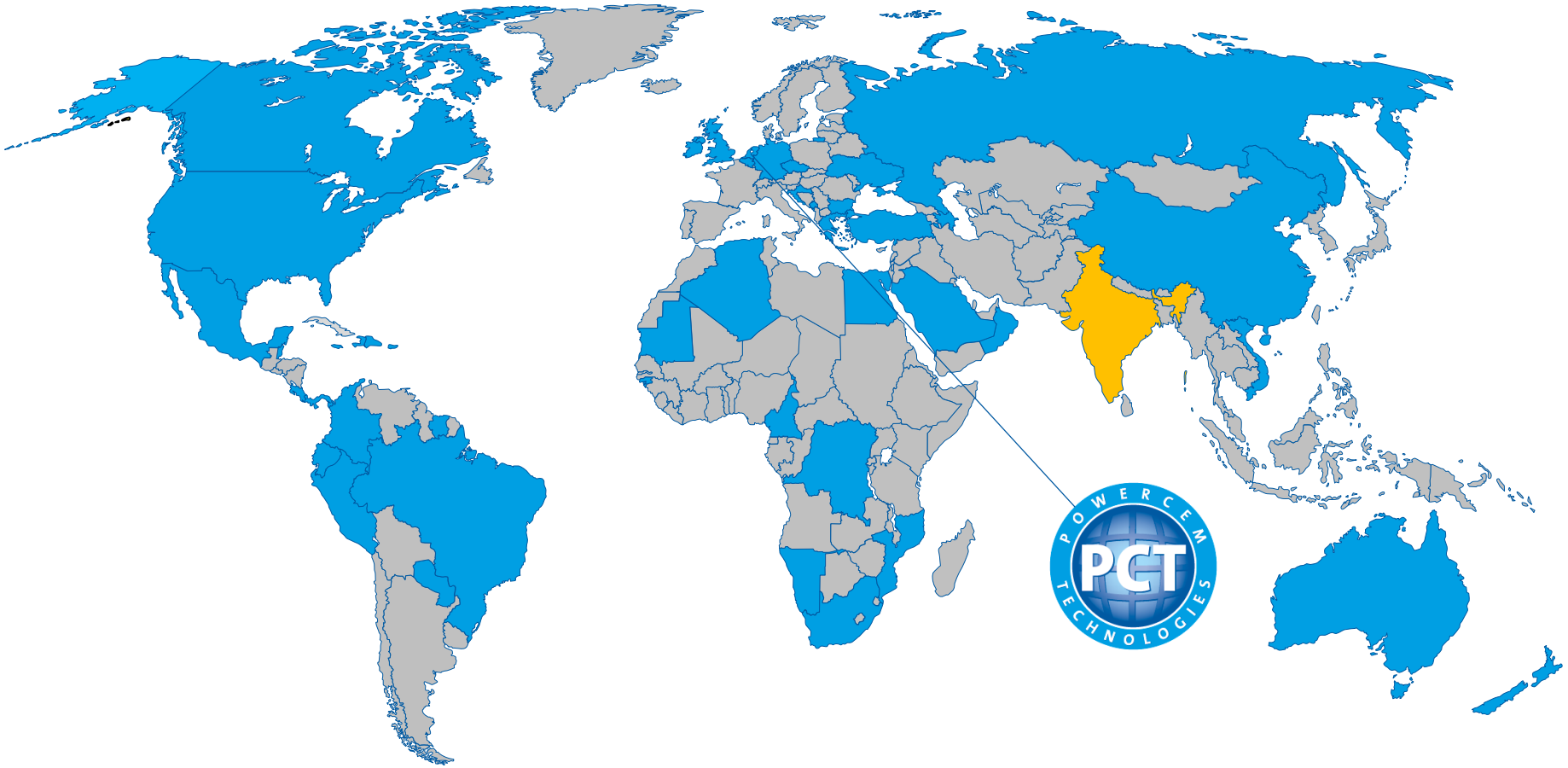
BRIEF INTRODUCTION

- Established: 1996, the Netherlands
- Established 2017: Official distributor for India - Elmer Enterprises Ltd

- **Specialization:** Modification of cement-bound materials
- **Mission statement:** Support the growth of the global economy and enhance people's lives through the development of sustainable infrastructure with our local partners.
- **Vision**: Providing infrastructural construction and environmental solutions whilst protecting the environment from the polluting effects of economic growth.
- **Track record:** PowerCem products have been successfully used in more than 40 countries to date.

POWERCEM GLOBAL PLAYER



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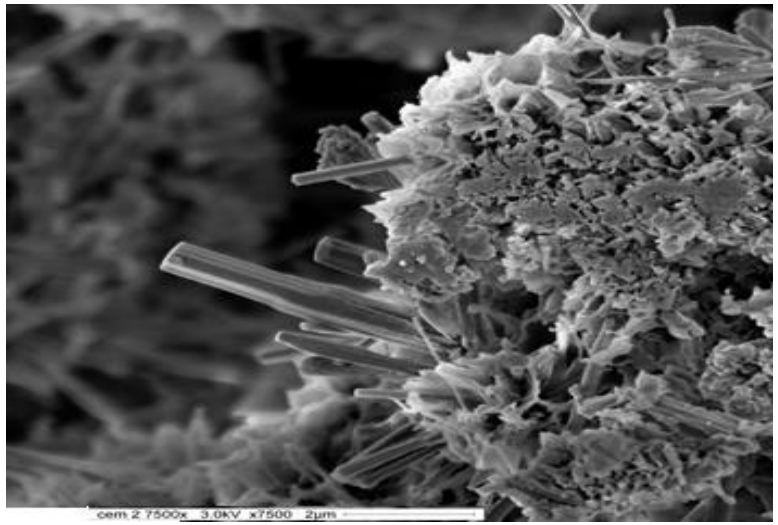
POWERCEM PRODUCTS - NANOTECHNOLOGY

- Special composition of synthetic zeolites and alkali earth metals.
- Developed as additive to chemically modify cement bound materials.



Nano Scale

1 Nanometer = 0,000.000.001 meter.

PowerCem Nanotechnology

Chemical process creates a crystalline needle matrix on Nano scale that form interlocking filaments (thread-like structures) between the material particles (soil & cement) resulting in a flexible structure.

Literature: Nano indentation research on cement structures ***RADBOUD UNIVERSTY*** *(Netherlands) & Effects of using RoadCem,* ***ULSTER UNIVERSITY*** *(Ireland)*

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UNIQUE PROOF OF CRYSTALLISATION NANOSCALE

Executive summary

Electron Microscope | Nanoscale research

Reference:	He/Rr/PCT/IfMaM-2011
Date:	July 21, 2011
Researchers:	Nano*Lab* Nijmegen, Radboud University PowerCem Technologies BV.

Introduction

X-ray diffraction

Powder diffraction is a scientific technique using X-Rays on powder or microcrystalline samples for structural characterization of materials. The measurements were carried out with a D8 Advance Diffractometer by Nano*Lab* Nijmegen, Radboud University Nijmegen by Dr. J.A.A.W. Elemans.

The technology

PowerCem Technologies BV, The Netherlands, developed and patented products that are based on a unique composition of alkaline (earth) substances and synthetic zeolites, with the addition of activators. The products are used for the construction of roads, immobilization and in addition to concrete.

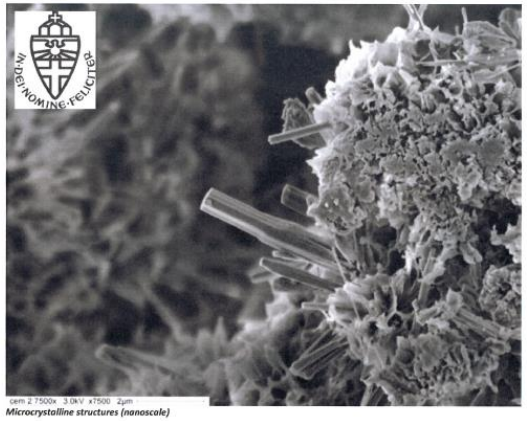
Scope

The products create a crystalline structure within the matrix. A sample of PowerCem has been scanned to examine with an Electron Microscope on which scale the formation of a crystalline structure develops.

Scanning Electron Microscope

To look for microcrystalline structures the samples were examined with a Scanning Electron Microscope. A small part of each sample was coated with a very thin film of conducting material. For both samples, several magnifications were used. An overview picture with a magnification of 200 x, more detail with 2000 x and pictures up to 20 000 x magnification were recorded.

Radboud Universiteit



Microcrystalline structures (nanoscale)

Conclusion

After a survey several locations were found in the samples which revealed microcrystalline structures. Needles up to 1 µm long and diameters less than 50 nm can clearly be detected in both samples. This clearly shows that the formation of a crystalline needle structure within the PowerCem samples has been detected on the nanoscale.

.....

Dr. J.A.A.W. Elemans
Associate Professor Molecular Nanotechnology
Nano*Lab* Radboud University
Nijmegen

Radboud Universiteit

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HVS – HEAVY VEHICLE SIMULATION
320.000 AXLE LOADS OF 160 KN

Source: IMT Mexican Transport Institute

RESULTS HVS HIGHWAY BRAZIL

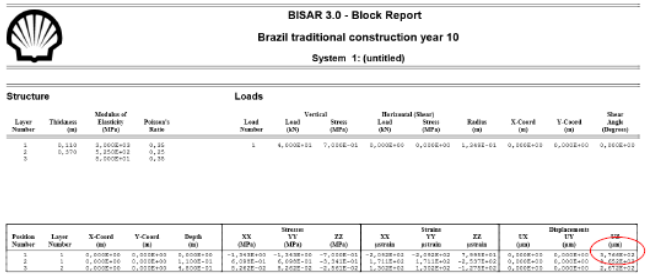
ARCADIS Design & Consultancy for natural and built assets

5.1.4.1 After 320.000 load cycles (10 years)

Input parameters

- the bearing capacity of the subsoil (80 MPa)
- the layer thickness of the asphalt (11 cm), after maintenance 3 cm extra asphalt is applied!
- the layer thickness of the foundation (37 cm for the traditional construction)
- the load and pressure of the FWD (40 kN and 700 kPa)
- the measured average deflection occurring under the load (see figure 12, red line), 37,5 * 10^{-2} mm, (375 µm/m)

Calculation interpolation of the stiffness after 10 years



BISAR 3.0 - Block Report

Brazil traditional construction year 10

System 1: (untitled)

Structure

Layer Number	Thickness (m)	Modulus of Elasticity (MPa)	Poisson's Ratio
1	0,110	3,000E+03	0,35
2	0,370	5,250E+02	0,25
3		8,000E+01	0,35

Loads

Load Number	Vertical Load (kN)	Vertical Stress (MPa)	Horizontal (Shear) Load (kN)	Horizontal (Shear) Stress (MPa)	Radius (m)	X-Coord (m)	Y-Coord (m)	Shear Angle (Degrees)
1	4,000E+01	7,000E-01	0,000E+00	0,000E+00	1,349E-01	0,000E+00	0,000E+00	0,000E+00

Position Number	Layer Number	X-Coord (m)	Y-Coord (m)	Depth (m)	Stresses XX (MPa)	Stresses YY (MPa)	Stresses ZZ (MPa)	Strains XX µstrain	Strains YY µstrain	Strains ZZ µstrain	Displacements UX (µm)	Displacements UY (µm)	Displacements UZ (µm)
1	1	0,000E+00	0,000E+00	0,000E+00	-1,341E+00	-1,341E+00	-7,000E-01	-2,262E+02	-2,262E+02	7,995E+01	0,000E+00	0,000E+00	1,744E+02
2	1	0,000E+00	0,000E+00	1,100E-01	6,098E-01	6,098E-01	-3,941E-01	1,711E+02	1,711E+02	-2,537E+02	0,000E+00	0,000E+00	1,452E+02
3	2	0,000E+00	0,000E+00	4,800E-01	5,241E-02	5,241E-02	-3,541E-02	1,302E+02	1,302E+02	-1,273E+02	0,000E+00	0,000E+00	1,413E+02

Figure 21: Interpolation calculation to determine the stiffness of the asphalt and foundation layer corresponding with the deflection found applying the FWD, after 320.000 axle load repetitions of 160 kN.

Results

Construction	Thickness	Stiffness
Asphalt	11 cm	3.000 N/mm^2
Base	37 cm	525 N/mm^2
Subsoil	-	80 N/mm^2

Table 15 Material stiffness asphalt pavement construction after 320.000 cycles of 160 kN.

Conclusion

The asphalt strength and the foundation strength are reduced drastically, after 320.000 cycles of 160 kN.

Construction	Stiffness asphalt prior to load	Stiffness asphalt after 10 year	Reduction	Stiffness foundation prior to load	Stiffness foundation after 10 year	Reduction
Traditional	11000 N/mm^2	3000 N/mm^2	-72,72%	3500 N/mm^2	525 N/mm^2	-85%

Table 16 Material stiffness reduction in the asphalt pavement construction after 320.000 cycles of 160 kN.

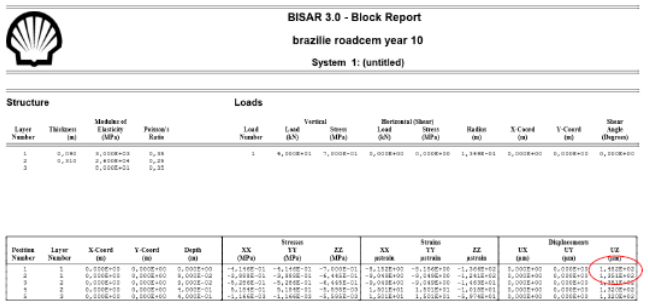
ARCADIS Design & Consultancy for natural and built assets

5.1.5.2 After 320.000 load cycles (10 years)

Input parameters

- the bearing capacity of the subsoil (80 MPa)
- the layer thickness of the asphalt (9 cm),
- the layer thickness of the foundation (31 cm)
- the load and pressure of the FWD (40 kN and 700 kPa)
- the measured average deflection occurring under the load (see figure 13, red line), 14,9 * 10^{-2} mm, (149 µm/m)

Calculation interpolation of the stiffness after 10 years



BISAR 3.0 - Block Report

brazilie roadcem year 10

System 1: (untitled)

Structure

Layer Number	Thickness (m)	Modulus of Elasticity (MPa)	Poisson's Ratio
1	0,090	3,000E+03	0,35
2	0,310	2,400E+04	0,25
3		8,000E+01	0,35

Loads

Load Number	Vertical Load (kN)	Vertical Stress (MPa)	Horizontal (Shear) Load (kN)	Horizontal (Shear) Stress (MPa)	Radius (m)	X-Coord (m)	Y-Coord (m)	Shear Angle (Degrees)
1	4,000E+01	7,000E-01	0,000E+00	0,000E+00	1,349E-01	0,000E+00	0,000E+00	0,000E+00

Position Number	Layer Number	X-Coord (m)	Y-Coord (m)	Depth (m)	Stresses XX (MPa)	Stresses YY (MPa)	Stresses ZZ (MPa)	Strains XX µstrain	Strains YY µstrain	Strains ZZ µstrain	Displacements UX (µm)	Displacements UY (µm)	Displacements UZ (µm)
1	1	0,000E+00	0,000E+00	0,000E+00	-6,146E-01	-6,146E-01	-7,000E-01	-8,152E+00	-8,156E+00	-1,366E+02	0,000E+00	0,000E+00	1,462E+02
2	1	0,000E+00	0,000E+00	9,000E-02	-2,868E-01	-2,868E-01	-6,465E-01	-9,049E+00	-9,049E+00	-1,241E+02	0,000E+00	0,000E+00	1,351E+02
3	2	0,000E+00	0,000E+00	4,000E-01	5,154E-02	5,154E-02	-5,555E-03	1,901E+01	1,901E+01	-1,953E+01	0,000E+00	0,000E+00	1,322E+02
4	2	0,000E+00	0,000E+00	7,000E-01	1,144E-03	1,144E-03	-5,555E-03	1,901E+01	1,901E+01	-1,953E+01	0,000E+00	0,000E+00	1,322E+02

Figure 24: Interpolation calculation to determine the stiffness of the asphalt and RoadCem layer corresponding with the

Results

Construction	Thickness	Stiffness
Asphalt	9 cm	3.000 N/mm^2
Base	31 cm	26.000 N/mm^2
Subsoil	-	80 N/mm^2

Table 19 Material stiffness RoadCem pavement construction after 320.000 cycles of 160 kN.

Conclusion

After 320.000 cycles of 160 Kn, the asphalt strength is reduced, however the RoadCem strength is not reduced

Construction	Stiffness asphalt prior to load	Stiffness asphalt after 10 year	Reduction	Stiffness foundation prior to load	Stiffness foundation after 10 year	Reduction
RoadCem	11000 N/mm^2	3000 N/mm^2	-72,72%	26000 N/mm^2	26000 N/mm^2	0%

Table 20 Material stiffness reduction in the asphalt pavement construction after 320.000 cycles of 160 kN.

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FLOOD RESISTANT – IMPERMEABLE
UNESCO RECOMMENDED

UNESCO-IHE
Institute for Water Education

Macro-economic Effects of Using the PowerCem Technology on Road Infrastructure in flood risk Areas

Ref nr: RC.INT.17.24052012

May 24th, 2012

SCT
SECRETARÍA DE COMUNICACIONES Y TRANSPORTES

UNESCO

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APPLICATIONS

Road infrastructure

Storage- parking areas

Container terminals

Industrial flooring

Contaminated areas

Ports

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AMBOTO

SUNGKHA

THEKRUJEMA

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POWERCEM PRODUCT
PROVEN EFFECTIVITY, RELIABILITY, QUALITY

ROADCEM
BASED ON POWERCEM TECHNOLOGIES
PCT

BRENNTAG

CERTIFIED ISO 9001:2015 COMPANY

CERTIFIED ISO 14001:2015 COMPANY

Packaging: Bags of 25kg
Quality Control: Serial Nº

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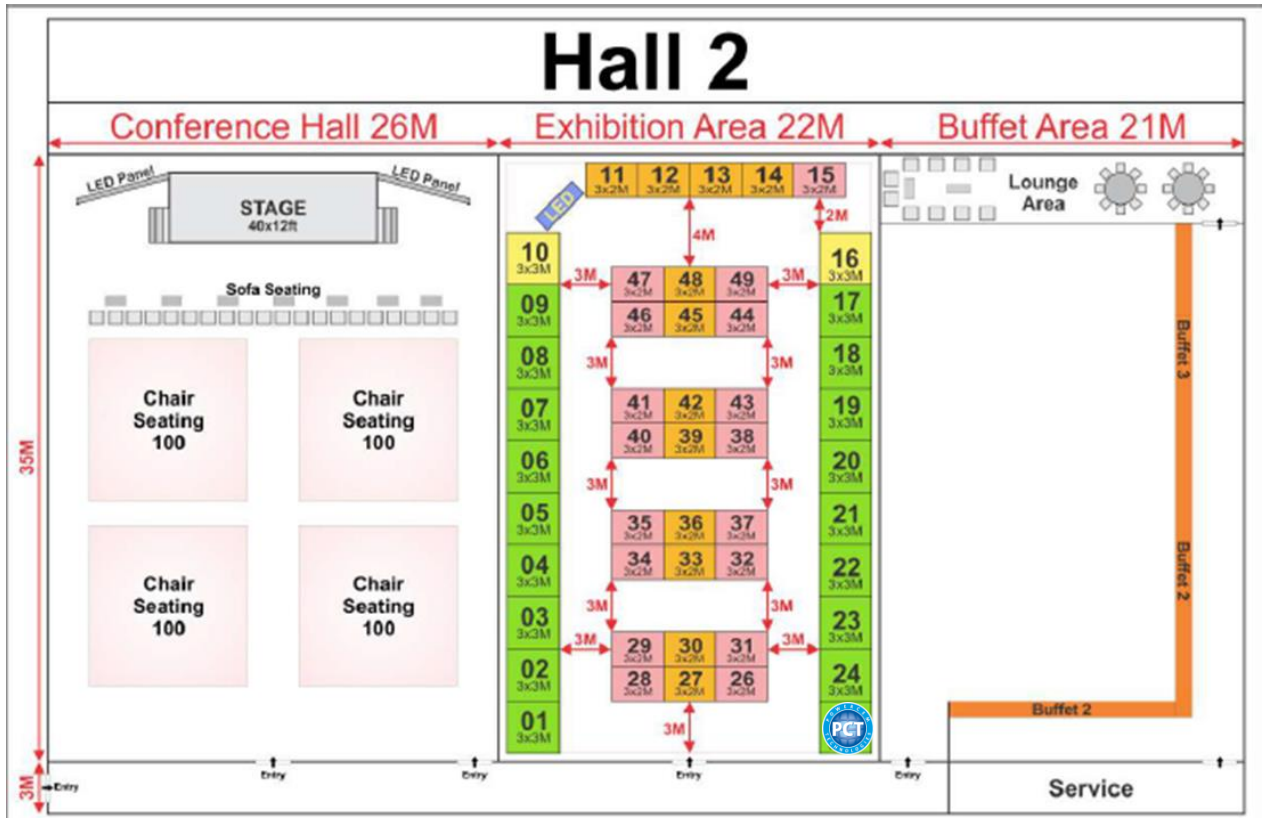
You will find us here



Thank you for your attention

Bahut Dhanyavaad
बहुत धन्यवाद्

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NAGALAND PUBLIC WORKS DEPARTMENT

FDR USING ROADCEM IN NAGALAND

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NAGALAND PUBLIC WORKS DEPARTMENT

- 4 PROJECTS
- DIFFERENT SOIL TYPES

NAGALAND PUBLIC WORKS DEPARTMENT

25 JULY 2021

26 MARCH 2022

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COST COMPARISON

- CONVENTIONAL METHOD WITH
- GSB
- 1 LAYER WBM Gr-II
- 1 LAYER WBM Gr- III
- COST =61.66 L/km

- FDR WITH ROADCEM
- THICKNESS = 210 mm
- 7-8 % CEMENT
- 0.08 % ROADCEM
- COST = 49.69 L/km

Saving = 19.41%

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THANK YOU

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